इंटरनेट मानक

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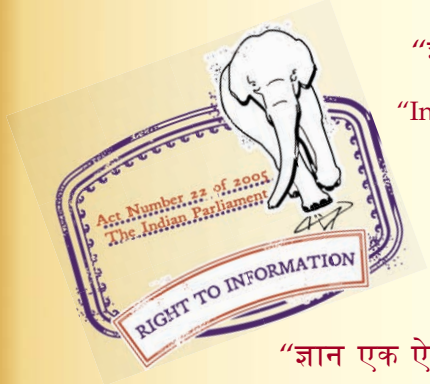
IS 3734 (1983): Dimensions for worm gearing [PGD 31: Bolts, Nuts and Fasteners Accessories]



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"Knowledge is such a treasure which cannot be stolen"

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Indian Standard (Reaffirmed 2005)

DIMENSIONS FOR WORM GEARING

(First Revision)

Gears Sectional Committee, EDC 59 [Ref : Doc : EDC 59 (3684)]

1. Scope — Covers dimensions and basic rack for machine cut worm gears of modules 1 to 20 and of reduction ratios from 5 to 70.

2. Terminology

2.1 For the purpose of this standard, the definitions and notations given in IS : 5267-1969 'Glossary of terms for worm gears', and IS : 2467-1963 'Notation for toothed gearing' shall apply.

2.2 The following additional terms shall also apply:

m = axial module
mn = normal module = $m \cos \gamma$
where γ = lead angle of worm thread

3. Profile of the Basic Rack

3.1 The normal section of the basic rack shall be as shown in Fig. 1.

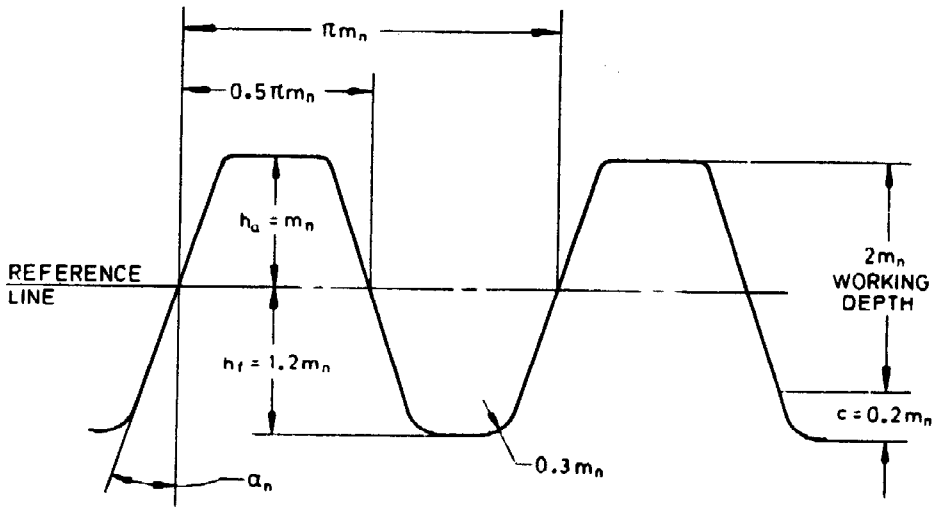

FIG. 1 NORMAL SECTION OF BASIC RACK

Note — The tools used for basic rack conforming to IS : 2535-1978 'Basic rack and modules of cylindrical gears for general engineering and heavy engineering (*second revision*)' are allowed as an option.

4. Shape and Dimensions

4.1 The shape of the worm thread shall be of the involute helicoid form of pressure angle 20° (*see* Fig. 2).

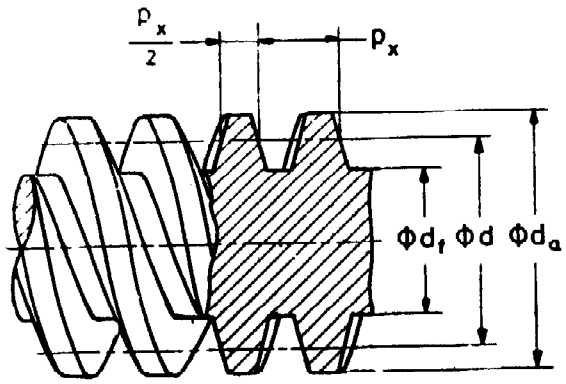

FIG. 2 INVOLUTE HELICOID THREAD FORM

4.2 The dimensions of the worm shall be as given in Table 1.

4.3 The recommended transmission ratios, centre distances and corresponding values for number of starts on the worm, number of teeth of the worm wheel, diameteral quotient of the worm and module are given in Table 2.

Adopted 26 August 1983 Gr 3

BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
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TABLE 1 DIMENSIONS OF WORMS

(*Clause* 4.2)

Axial Module m (mm)	Axial Pitch p_x (mm)	No. of Starts z_1	Diameteral Quotient q	Reference Diameter d (mm)	Tip-Diameter d_a (mm)	Root Diameter d_f (mm)	Load Angle γ
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
0·55	1·728	1	20	11·00	12·10	9·68	2°52′
0·65	2·042	1	18	11·70	13·00	10·14	3°12′
0·75	2·356	1	14	10·50	12·00	8·71	4°05′
0·75	2·356	1	16	12·00	13·50	10·21	3°35′
0·85	2·670	1	14	11·90	13·60	9·87	4°05′
0·95	2·985	1	14	13·30	15·20	11·03	4°05′
1·0	3·142	1	13	13·00	15·00	10·61	4°24′
1·1	3·456	1	13	14·30	16·50	11·67	4°24′
1·2	3·770	1	13	15·60	18·00	12·74	4°24′
1·25	3·927	1	10	12·50	15·00	9·53	5°43′
1·25	3·927	1	11	13·75	16·25	10·77	5°12′
1·25	3·927	1	13	16·25	18·75	13·27	4°24′
1·25	3·927	2	10	12·50	15·00	9·61	11°19′
1·35	4·241	1	13	17·55	20·25	14·33	4°24′
1·5	4·712	1	8½	12·75	15·75	9·20	6°43′
1·5	4·712	1	13	19·50	22·50	15·92	4°24′
1·5	4·712	2	8½	12·75	15·75	9·33	13°14′
1·6	5·027	1	11	17·60	20·80	13·79	5°12′
1·65	5·184	1	9½	15·675	18·975	11·75	6°01′
1·65	5·184	1	12	19·80	23·10	15·87	4°46′
1·65	5·184	2	9½	15·675	18·975	11·87	11°53′
1·65	5·184	3	8½	14·025	17·325	10·48	19°26′
1·75	5·498	1	12	21·00	24·50	16·83	4°46′
1·85	5·812	1	8	14·80	18·50	10·42	7°08′
1·85	5·812	1	9	16·65	20·35	12·26	6°20′
1·85	5·812	2	8	14·80	18·50	10·60	14°02′
1·85	5·812	2	9	16·65	20·35	12·40	12°32′
1·85	5·812	4	8	14·80	18·50	11·22	26°34′
1·95	6·126	1	13	25·35	29·25	20·70	4°24′
2·0	6·283	1	9	18·00	22·00	13·25	6°20′
2·0	6·283	1	10	20·00	24·00	15·24	5°43′
2·0	6·283	1	12	24·00	28·00	19·23	4°46′
2·0	6·283	2	9	18·00	22·00	13·41	12°32′
2·0	6·283	3	8½	17·00	21·00	12·70	19°26′
2·25	7·069	1	8	18·00	22·50	12·68	7°08′
2·25	7·069	1	12	27·00	31·50	21·63	4°46′
2·25	7·069	2	8	18·00	22·50	12·90	14°02′
2·25	7·069	4	8	18·00	22·50	13·65	26°34′
2·5	·854	1	8	20·00	25·00	14·09	7°08′
2·5	7·854	1	9½	23·75	28·75	17·81	6°01′
2·5	7·854	1	11	27·50	32·50	21·55	5°12′
2·5	7·854	2	8	20·00	25·00	14·33	14°02′
2·5	7·854	5	8	20·00	25·00	15·67	32°00′
2·6	8·168	1	7½	19·50	24·70	13·36	7°36′
2·6	8·168	1	11	28·60	33·80	22·41	5°12′
2·6	8·168	2	7½	19·50	24·70	13·65	14°56′
2·6	8·168	3	8	20·80	26·00	15·29	20°33′
2·75	8·639	1	8	22·00	27·50	15·49	7°08′
2·75	8·639	1	12	33·00	38·50	26·44	4°46′
2·75	8·639	2	8	22·00	27·50	15·76	14°02′
3	9·425	1	8	24·00	30·00	16·90	7°08′
3	9·425	1	12	36·00	42·00	28·85	4°46′
3	9·425	2	8	24·00	30·00	17·19	14°02′
3	9·425	5	8	24·00	30·00	18·81	32°00′
3·25	10·210	1	8	26·00	32·50	18.31	7°08′
3·25	10·210	1	9½	30·875	37·375	23.15	6°01′
3·25	10·210	1	11	35·75	42·25	28.00	5°12′
3·25	10·210	2	8	26·00	32·50	18.63	14°02′
3·25	10·210	3	8	26·00	32·50	19.11	20°33′
3·5	10·996	1	7½	26·25	33·25	17·99	7°36′
3·5	10·996	1	11	38·5	45·50	30·16	5°12′
3·5	10·996	2	7½	26·25	33·25	18·37	14°56′

(*Continued*)

TABLE 1 DIMENSIONS OF WORMS — *Contd.*

Axial Module m (mm)	Axial Pitch p_x (mm)	No. of Starts z_1	Diameteral Quotient q	Reference Diameter d (mm)	Tip-Diameter d_a (mm)	Root Diameter d_f (mm)	Lead Angle γ
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
4	12·566	1	7½	30·00	38·00	20·55	7°36′
4	12·566	1	9	36·00	44·00	26·51	6°20′
4	12·566	1	11	44·00	52·00	34·47	5°12′
4	12·566	2	7½	30·00	38·00	20·99	14°56′
4	12·566	2	9	36·00	44·00	26·82	12°32′
4	12·566	3	9	36·00	44·00	27·30	18°26′
4	12·566	4	9	36·00	44·00	27·92	23°58′
*4	12·566	5	7½	30·00	38·00	23·76	33°41′
4	12·566	6	9	36·00	44·00	29·35	33°41′
4·25	13·352	1	9	38·25	46·75	28·16	6°20′
4·25	13·352	3	7½	31·875	40·375	23·01	21°48′
4·5	14·137	1	7	31·50	40·50	20·90	8°08′
4·5	14·137	1	10	45·00	54·00	34·30	5°43′
5	15·708	1	7	35·00	45·00	23·22	8°08′
5	15·708	1	9	45·00	55·00	33·13	6°20′
5	15·708	1	10	50·00	60·00	38·11	5°43′
5	15·708	2	7	35·00	45·00	23·85	15°57′
5	15·708	2	9	45·00	55·00	33·52	12°32′
5·5	17·279	1	7½	41·25	52·25	28·26	7°36′
5·5	17·279	1	9	49·50	60·50	36·45	6°20′
5·5	17·279	2	7½	41·25	52·25	28·87	14°56′
5·5	17·279	3	8½	46·75	57·75	34·93	19°26′
5·5	17·279	3	7½	41·25	52·25	29·78	28°48′
5·5	17·279	4	7½	41·25	52·25	30·90	28°04′
5·5	17·279	5	8½	46·75	57·75	36·89	30°28′
*5·5	17·279	6	7½	41·25	52·25	33·91	38°40′
5·75	18·064	1	9½	54·625	66·125	40·96	6°01′
6	18·850	1	7	42·00	54·00	27·87	8°08′
*6	18·850	7	8	48·00	60·00	40·20	41°11′
6·25	19·635	1	10	62·50	75·00	47·64	5°43′
6·5	20·420	1	7	45·50	58.50	30·19	8°08′
6·5	20·420	1	7½	48·75	61·75	33·40	7°36′
6·5	20·420	1	8½	55·25	68·25	39·85	6°43′
6·5	20·420	2	7	45·50	58·50	31·00	15°57′
6·5	20·420	2	7½	48·75	61·75	34·12	14°56′
6·5	20·420	2	8½	55·25	68·25	40·41	13°14′
6·5	20·420	3	7½	48·75	68·75	35·20	21°48′
6·5	20·420	4	8½	55·25	68·25	42·37	25°12′
6·75	21·206	1	8½	57·375	70·875	41·38	6°43′
7	21·991	2	8½	59·50	73·50	43·52	13°14′
7	21·991	3	8	56·00	70·00	41·16	20°33′
7	21·991	5	8	56·00	70·00	43·88	32°00′
7·25	22·777	1	9	65·25	79·75	48·04	6°20′
7·5	23·562	3	8½	63·75	78·75	47·63	19°26′
*7·5	23·562	7	7½	56·25	71·25	47·43	43°02′
8	25·133	1	6½	52·00	68·00	33·21	8°45′
8	25·133	1	9½	76·00	92·00	56·99	6°01′
8·5	26·704	1	7	59·50	76·50	39·48	8°08′
8·5	26·704	1	8	68·00	85·00	47·89	7°08′
8·5	26·704	2	7	59·50	76·50	40·54	15°57′
8·5	26·704	2	8	68·00	85·00	48·72	14°02′
8·5	26·704	4	8	68·00	85·00	51·55	26°34′
8·5	26·704	8	8	68·00	85·00	58·55	45°00′
9	28·274	1	9	81·00	99·00	59·64	6°20′
9	28·274	2	9	81·00	99·00	60·34	12°32′
9	28·274	3	7½	67·50	85·50	48·73	21°48′
*9	28·274	5	7½	67·50	85·50	53·45	33°41′
9	28·274	9	9	81·00	99·00	71·00	45°00′
9·5	29·845	3	7½	71·25	90·25	51·44	21°48′
*9·5	29·845	6	7½	71·25	90·25	58·58	38°40′
10	31·416	1	7	70·00	90·00	46·44	8°08′
10	31·416	1	9	90·00	110·00	66·27	6°20′

*Root diameter of worm is increased, that is, depth of the worm-thread is reduced to avoid undercutting. The diameter at the root of gorge on the worm wheel now lies on the base circle of the worm.

(*Continued*)

TABLE 1 DIMENSIONS OF WORMS — (Contd.)

Axial Module m (mm)	Axial Pitch p_x (mm)	No. of Starts z_1	Diameteral Quotient q	Reference Diameter d (mm)	Tip-Diameter d_a (mm)	Root Diameter d_f (mm)	Load Angle γ
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
10·5	32·987	1	7½	78·75	99·75	53·96	7°36′
10·5	32·987	2	7½	78·75	99·75	55·11	14°56′
10·5	32·987	4	7½	78·75	99·75	58·98	28°04′
*10·5	32·987	7	8	84·00	105·00	70·36	41°11′
10·5	32·987	10	10	105·00	126·00	93·33	45°00′
11	34·558	1	6½	71·50	93·50	45·66	8°45′
11	34·558	1	8	88·00	110·00	61·97	6°08′
11	34·558	2	8	88·00	110·00	63·04	14°02′
11	34·558	2	10	110·00	132·00	84·54	11°19′
11	34·558	4	8	88·00	110·00	66·71	26°34′
11	34·558	5	8	88·00	110·00	68·95	32°00′
12	37·699	1	8	96·00	120·00	67·61	7°08′
12	37·699	2	8	96·00	120·00	68·78	14°02′
12	37·699	3	7½	90·00	114·00	64·98	21°48′
12	37·699	3	8	96·00	120·00	70·56	20°33′
12	37·699	4	8	96·00	120·00	72·77	26°34′
12	37·699	11	11	132·00	156·00	118·66	45°00′
12·5	39·270	1	9	112·50	137·50	82·84	6°20′
13	40·841	1	7½	97·50	123·50	66·80	7°36′
13	40·841	2	7½	97·50	123·50	68·28	14°56′
13	40·841	7	8½	110·50	136·50	92·34	39°28′
14	43·982	1	6½	91·00	119·00	58·12	8°45′
14	43·982	1	8	112·00	140·00	78·88	7°08′
14	43·982	2	8	112·00	140·00	80·24	14°02′
14	43·982	4	8	112·00	140·00	84·90	26°34′
14	43·982	5	8	112·00	140·00	87·76	32°00′
14	43·982	5	8½	119·00	147·00	93·91	30°28′
14	43·682	12	12	168·00	196·00	152·44	45°00′
14.5	45·553	1	8	116·00	145·00	81.69	7°08′
14.5	45·553	2	8	116·00	145·00	83.10	14°02′
14.5	45·553	3	8	116·00	145·00	85.26	20°33′
14.5	45·553	4	8	116·00	145·00	87.94	26°34′
*14.5	45·553	6	8	116·00	145·00	94.55	36°52′
14.5	45·553	8	8	116·00	145·00	99.89	45.00′
17	53·407	1	7	119·00	153·00	78.95	8°08′
18	56·549	1	7	126·00	162·00	83.60	8°08′
18	56·549	2	7	126·00	162·00	85.85,	15°57′

*Root diameter of worm is increased, that is, depth of the worm-thread is reduced to avoid undercutting. The diameter at the root of gorge on the wormwheel now lies on the base circle of the worm.

TABLE 2 RECOMMENDED TRANSMISSION RATIOS, CENTRE DISTANCES AND CORRESPONDING z_1, z_2 q, m* PARTICULARS FOR GENERAL PURPOSE WORM GEARING

(*Clause* 4.3)

Transmission Ratio / Centre Distance (mm)	5/1	7.5/1	10/1	12.5/1	15/1	20/1	25/1	30/1	40/1	50/1	60/1	70/1
25	4/19/8/1·85	3/22/8½/1·65	2/19/8/1·85	2/25/8½/1·5	2/30/10/1·25	1/19/8/1·85	1/25/8½/1·5	1/30/10/1·25	1/39/14/·95	1/51/16/·75	1/59/18/·65	1/71/20/·55
31·5	4/20/8/2·25	3/23/8½/2	2/20/8/2.25	2/25/9/1·85	2/29/9½/1·65	1/20/8/2·25	1/25/9/1·85	1/29/9½/1·65	1/40/11/1·25	1/50/13/1	1/60/14/·85	1/70/14/·75
40	5/24/8/2·5	3/23/8/2·6	2/21/8/2·75	2/24/8/2·5	2/31/9/2	1/21/8/2·75	1/24/8/2·5	1/31/9/2	1/39/11/1·6	1/51/13/1·25	1/60/13/1·1	1/70/14/·95
50	5/25/8/3	3/23/8/3·25	2/21/7½/3·5	2/25/8/3	2/31/7½/2·6	1/21/7½/3·5	1/25/8/3	1/31/7½/2·6	1/40/10/2	1/49/12/1·65	1/61/13/1·35	1/70/13/1·2
63	5/24/7½/4	3/22/7½/4·25	3/31/8/3·25	2/24/7½/4	2/31/8/3·25	1/21/7/4·5	1/24/7½/4	1/31/8/3·25	1/41/9½/2·5	1/51/12/2	1/60/12/1·75	1/71/13/1·5
80	6/31/9/4	4/31/9/4	3/31/9/4	2/25/7/5	2/31/9/4	1/20/7/6	1/25/7/5	1/31/9/4	1/40/9½/3·25	1/51/11/2·6	1/59/12/2·25	1/69/13/1·95
100	6/29/7½/5·5	4/29/7½/5·5	3/29/7½/5·5	2/24/7/6·5	2/29/7½/5·5	2/41/9/4	1/24/7/6·5	1/29/7½/5·5	1/41/9/4	1/51/11/3·25	1/61/12/2·75	1/69/11/2·5
125	7/34/8/6	5/37/8½/5·5	3/31/7½/6·5	3/37/8½/5·5	2/31/7½/6·5	2/41/9/5	1/25/6½/8	1/31/7½/6·5	1/41/9/5	1/50/9/4·25	1/61/11/3·5	1/71/12/3
160	7/35/7½/7·5	5/38/8/7	4/41/8½/6·5	3/38/8/7	2/31/7/8·5	2/41/8½/6·5	1/25/7/10	1/31/7/8·5	1/41/8½/6·5	1/49/9/5·5	1/61/10/4·5	1/69/11/4
200	8/39/8/8·5	5/37/7½/9	4/39/8/8·5	3/37/7½/9	3/45/8½/7·5	2/39/8/8.5	2/49/8½/7	1/30/6½/11	1/39/8/8·5	1/51/8½/6·75	1/60/9½/5·75	1/70/10/5
250	9/46/9/9	6/45/7½/9·5	4/40/7½/10·5	4/51/8/8·5	3/45/7½/9·5	2/40/7½/10·5	2/51/8/8·5	1/29/6½/14	1/49/7½/10·5	1/51/8/8·5	1/60/9/7·25	1/70/10/6·25
315	10/50/10/10·5	7/52/8/10·5	5/49/8/11	4/49/8/11	3/45/7½/12	4/41/7½/13	2/49/8/11	2/61/9/9	1/41/7½/13	1/49/8/11	1/61/9/9	1/69/9½/8
400	11/56/11/12	7/53/8½/13	5/49/8/14	4/49/8/14	4/59/8/12	3/59/8/12	2/49/8/14	2/59/8/12	1/40/7/17	1/49/8/14	1/59/8/12	1/71/9/10
500	12/59/12/14	8/61/8/14·5	6/61/8/14·5	5/63/8½/14	4/61/8/14·5	3/61/8/14·5	2/49/7/18	2/61/8/14·5	2/81/10/11	1/49/7/18	1/61/8/14·5	1/71/9/12·5

*z_1 = Number of satrts of the worm

z_2 = Number of teeth of the wormheel

q = diameter quotient = $\frac{d}{m}$

m = Axial module (mm)

5. Designation

5.1 A pair of worm gears shall be designated by the hand of the thread of the worm, number of starts of the worm, number of teeth of the wheel, diameteral quotient of the worm, module and centre distance of the gear pair.

Example:

When a worm with right hand thread and number of starts as 6 meshes with a worm wheel of 31 teeth, diameteral quotient of the worm being 9, and module 8 at a centre distance of 160 mm, then the gear pair shall be designated as:

Worm Gears R 6/31/9/8-160 mm

6. Marking

6.1 The worms shall be marked with the module, the diameteral quotient and manufacturer's name or trade-mark.

EXPLANATORY NOTE

As the field of worm gear manufacturing technique is in itself quite vast and complicated, it might not be possible or advisable to lay down a strict specification for worm gearing. It is, however, necessary to eliminate the large disparity in the manufacturing practice and standardize on a very broad basis without unduly restricting in any way the scope of the designer or manufacturer. Hence the need for this standard.

The main practices commonly in use are the British and the European systems. Though the predominant usage in the country is of the British Standards, considerable attention has been paid to the metric standards prevailing in Europe too, as metric system has been adopted in the country.

Since the $z_1/z_2/q/m$ system of worm gears designation as used in British Standards is simpler and much easier for application, the present standard has been prepared adopting the same system suitably for metric sizes.

Centre distances have been selected from the R10 series. The transmission ratios have been specified in nominal values. The exact ratios if required can be calculated from Table 2.

This standard covers general purpose worm gears only and does not include worm gears for automobiles. The main dimensions of the worms only have been specified.

It is recommended that the worm threads should be right-hand; left-hand threads may be used in exceptional cases.

Regarding the shape of the worm thread, the involute helicoid form is specified because of the ease of manufacture and inspection. The straight sided axial and straight sided normal section thread forms would however be permissible till such a time as the necessary tools and equipment for the involute form are available.

The pressure angle shall be 20° but deviations necessary for obtaining exact thread forms shall be permitted.

Since the irreversibility of a worm gear pair depends not only on the lead angle but on other factors, such as coefficient of friction, and rubbing speed, it is left to the designer to determine the irreversibility of any particular pair under specific conditions.

It is not always possible that the sum of the radii of the reference cylinders of the worm and worm wheel be equal to the centre distance. The values of the transmission ratios and diameter factors are specified with a view that the above difference does not exceed +0·5 module in all cases.

This standard was first published in 1966. In the present revision the profile of basic rack and additional terminology peculiar to worm gearing have been added. For some of the centre distance-transmission ratio combinations, $z_1/z_2/q/m$ particulars have been revised in order to obtain better ratings. Typical drawings in order to obtain the required worm gear pairs have been deleted since they are being covered in greater detail in IS : 10185-1982 'Data for procurement of worm and worm wheels'.

In the preparation of this standard, assistance has been derived from BS :-721-1963 'Worm gearing', issued by the British Standards Institution.

Reprography Unit, BIS, New Delhi, India

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TO
IS 3734 : 1983 DIMENSIONS FOR WORM GEARING

(First Revision)

(*Page* 5, *Table* 2) — Insert the following Note below the table:

'NOTE —Centre distance shall be considered as an imperial value.'

(BP 13)

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